

**SECTION A. Project Title: Experimental investigation and development of models and correlations for cladding-to-coolant heat transfer phenomena in transient conditions in support of TREAT and the LWR fleet – Massachusetts Institute of Technology**

**SECTION B. Project Description**

The Massachusetts Institute of Technology (MIT) proposes to use high-resolution diagnostics (e.g., infrared thermometry and optical fibers) to extend the understanding of heat transfer mechanisms and characterize the performance of Zircaloy and ATF fuel cladding materials (with a focus on Cr-coated Zircaloy). Project objectives include: 1) Elucidate heat transfer phenomena between the fuel cladding and the coolant in transient conditions, with a focus on CHF and post-CHF conditions; 2) Generate a comprehensive database to critically evaluate existing models and correlations, and benchmark modeling tools developed by NEAMS and/or in use by the nuclear community, including thermal-hydraulics codes (e.g., CTF and RELAP5) and fuel performance codes (e.g., BISON); 3) Verify fundamental hypothesis and develop physical models and correlation to model these phenomena with the aforesaid computational tools; and 4) Support the LWR fleet and the TREAT research programs with new understanding, targeted experimental results, and modeling with new and representative physical models and correlations. The research team will take advantage of the high-resolution experimental techniques previously developed to perform carefully controlled, separate effect experiments of transient heat transfer. The objective of these experiments is to shed light on these phenomena and develop physical models and correlations to be integrated in computational tools used for the design and the safety analysis of nuclear systems (e.g., CTF, RELAP, or BISON) and relevant to both the TREAT testing program and the existing PWR fleet.

**SECTION C. Environmental Aspects / Potential Sources of Impact**

Chemicals are used for cleaning the samples to test. The list of chemicals includes solvents, e.g., ethanol and acetone. They are stored in a chemical cabinet, according to the directions of the MIT EHS (environment, health, and safety) department, and disposed as chemical wastes according to the rules of the MIT EHS. The researchers will use roughly 2 gallons of solvents throughout the duration of the project (i.e., three years). Boiling experiments are run using de-ionized water. This water is not contaminated and can be discharged as wastewater. It is estimated that the total water consumption for the project will be less than 5 cubic meters.

**SECTION D. Determine the Level of Environmental Review (or Documentation) and Reference(s):** Identify the applicable categorical exclusion from 10 CFR 1021, Appendix B, give the appropriate justification, and the approval date.

Note: For Categorical Exclusions (CXs) the proposed action must not: 1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, including requirements of DOE orders; 2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities; 3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; 4) adversely affect environmentally sensitive resources. In addition, no extraordinary circumstances related to the proposal exist which would affect the significance of the action, and the action is not “connected” nor “related” (40 CFR 1508.25(a)(1) and (2), respectively) to other actions with potentially or cumulatively significant impacts.

References: B3.6 Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). For purposes of this category, “demonstration actions” means actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment. Demonstration actions frequently follow research and development and pilot projects that are directed at establishing proof of concept.

Justification: The activity consists of an investigation to examine thermal-hydraulics transient heat transfer phenomena of relevance for fuel performance analyses, and to the safety and operation of the TREAT and LWR reactors.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act)  Yes  No

Approved by Jason Anderson, DOE-ID NEPA Compliance Officer, on 08/31/2021.